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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/538,972	06/14/2005	Tapani Levola	915-005.168	9487
4955	7590	03/06/2006	EXAMINER	
WARE FRESSOLA VAN DER SLUYS & ADOLPHSON, LLP BRADFORD GREEN BUILDING 5 755 MAIN STREET, P O BOX 224 MONROE, CT 06468			PEACE, RHONDA S	
			ART UNIT	PAPER NUMBER
			2874	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/538,972	Applicant(s) LEVOLA, TAPANI	
	Examiner Rhonda S. Peace	Art Unit 2874	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-11 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-11 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 June 2005 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|--|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>6/14/2005</u> | 6) <input type="checkbox"/> Other: ____ |

DETAILED ACTION

Priority

Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file of this National Stage application from the International Bureau (PCT Rule 17.2(a)).

Information Disclosure Statement

The information disclosure statement (IDS) submitted on 6/14/2005 was filed in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement is being considered by the examiner.

Drawings

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the *enlarged exit pupil* claimed in claims 9-11 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for

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consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

The drawings are further objected to because of the following informalities which make the drawing unsuitable for publication: excessive shading in Figures 4 and 8-10 making the drawing illegible, and handwritten indicators in Figure 12. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the

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applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 3, and 6 are rejected under 35 U.S.C. 102(b) as being anticipated by Yoshida et al (US 5101297).

Addressing claims 1, 3, and 6, Yoshida et al discloses a diffractive grating element **15** arranged on a substrate **11** with waveguiding layer **12**, and arranged to interact with an incoming light wave from source **40** so that the incident light is coupled into the substrate **11** and is diffracted into a first order wave **21**, which propagates within waveguiding layer **12**, and a second order wave **22**, which propagates within the substrate **11**. The diffraction grating element **15** can be divided into two diffraction grating regions about their axis of symmetry, so that each region has differing diffractive properties due to the grating's **15** curved shape, as seen in Figure 1. As the axis of symmetry, seen along the direction of waveguide layer **12** in Figure 1A, is considered to be a transition point, the regions are substantially mirror images of one another with respect to the transition point. As can be seen in Figures 1A and 1B, the incident light from source **40** first interacts with the grating **15** along the transition point. The diffraction regions mutually compensate for a variation of input angle (see Fig 1) of the

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incident light wave, so that both first **21** and second **22** order diffracted waves are propagated within the substrate **11** and substrate waveguiding layer **12**. Each of the first **21** and second **22** order waves will inherently have their own diffraction efficiency (column 3 lines 44-61, hereafter indicated as 3:44-61, 4:11-18 and 37-65, Figs 1A and 1B).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 2 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yoshida et al (US 5101297) in further view of Sakai et al (US 5279924).

Pertaining to claim 2, Yoshida et al discloses the grating device as discussed above. However, Yoshida et al does not disclose the grating **15** to be of an asymmetric period profile or a blazed grating. Sakai et al also discloses an optical diffraction grating element that allows incident light to be diffracted into first and second orders that

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propagate with equal intensities within the substrate supporting the grating (10:1-19, Figure 6C). In addition, Sakai et al also discloses the grating is of an asymmetrical periodic profile, and is preferably a blazed period profile (7:24-27, Fig 1F). It would have been obvious to one of ordinary skill in the art to combine the teachings of a asymmetrical, preferably blazed, periodic profile grating (from Sakai et al) with the teachings of Yoshida et al, because these gratings types improve the optical efficiency of any device having the grating, such as an optical head device (Sakai et al, 7:37-53).

Regarding claim 4, Yoshida et al discloses the grating device as discussed above. However, Yoshida et al does not disclose the two different grating regions having two substantially differing depths. Sakai et al discloses a grating which is arranged to have two sub-regions **4a** and **4b**, where each sub-region has a substantially different depth, t_1 and t_2 , respectively (2:65-68, 3:1-17, Fig 10B). One of ordinary skill in the art would have found it obvious to combine the teachings of Sakai et al (a grating with two sub-regions where each sub-region has a substantially different depth) with the teachings of Yoshida et al, as a grating with differing depths is well known in the art, and a grating with differing depths causes the diffraction efficiency of the first region to be unequal to the diffraction efficiency of the second region, thereby allowing for a grating which can be highly tailored to several desired diffraction efficiencies at various portions along the grating (Sakai et al, 3:13-25).

Claims 5, 7, and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yoshida et al (US 5101297) in further view of Schultz et al (US 6285813).

With regards to claim 5, Yoshida et al discloses the grating device as discussed above. However, Yoshida et al does not disclose the diffraction efficiency of at least one of the grating regions is arranged to vary at differing local distances from the transition point. Schultz et al discloses a diffraction grating coupler that couples incident light into a substrate. Splitting the grating of Figure 4 into two equal grating regions where the split occurs at the transition point, clearly Schultz et al also shows the diffraction efficiency of both grating regions are arranged to vary at differing local distances from the transition point (5:37-41 and 60-64, Fig 4). It would have been obvious to one of ordinary skill in the art to combine the teachings of Schultz et al (a grating in which the sub-regions have varying diffraction efficiency along the length of each sub-grating with respect to the transition point) with the teachings of Yoshida et al, as this grating structure is easily adaptable to gain the desired diffraction results, such as diffraction of incident light at a predetermined angle; also this grating structure allows for customization so that the desired light intensity profile along the grating is achieved (Schultz et al, 5:41-64)

Addressing claim 7, Yoshida et al discloses the grating device as discussed above. However, Yoshida et al does not disclose grating regions such that the incident light wave has its first interaction with the grating within a single grating region. Schultz et al discloses a diffraction grating coupler that couples incident light into a substrate, where the grating is fashioned to allow any desired diffraction properties to be realized, as the diffraction efficiency of the grating is dependent upon the slant angle of the grating (5:37-45, Fig 4). In addition, Schultz et al also teaches that light may be incident

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upon the side of the substrate holding the grating, as well as the top portion of the grating (5:52-59). It would have been obvious to one of ordinary skill in the art to combine the teachings of Schultz et al (that light may be shown on the grating in several locations in order to get the desired diffraction efficiency and intensity) with the teachings of Yoshida et al, as this allows the grating to be manufactured in an extremely specialized way, such that a wide variety of coupling characteristics can be achieved with the grating by simply varying where light is shown on the grating, as the grating's diffractive characteristics vary along the grating length (Schultz et al, 5:37-65, Fig 4).

With respect to claim 8, Yoshida et al and Schultz et al disclose the grating device as discussed above. Yoshida et al does not disclose having the gratings regions arranged such that at least one of the regions redirects light back in a reverse direction inside the substrate. Schultz et al discloses light may be input from above the grating and be refracted in a reverse direction inside the substrate, with the proper fashioning of the fringes of the grating, as the fringes, having a slant angle, are proportional to the diffraction intensity and also the diffraction angle of the light wave as it travels through the substrate (Fig 4, 5:37-65). It would have been obvious to one of ordinary skill in the art to combine the teachings of Schultz et al (slant angle can be fashioned in a any manner to produce the desired diffraction effect, including the effect where light is recirculated or redirected in a reverse direction within the substrate), as this allows the grating to function in a wide variety of applications, as light may be emitted from either side of the substrate, instead of from just one end.

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Claims 9-11 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Yoshida et al (US 5101297). See MPEP 2112 [R3], Section III.

Regarding claims 9-11, Yoshida et al discloses the grating device as discussed above, disclosing all of the structural limitations of the current invention's claim 1. However, Yoshida et al does not disclose the function of using the grating to enlarge an exit pupil of an optical system, monocular system, binocular system, or virtual display. However, as Yoshida et al discloses an optical grating coupler device, it would have been obvious to one of ordinary skill in the art to utilize such a device in any optical system which requires an optical coupler (a grating for coupling light into and out of a substrate), such as an optical system, monocular system, binocular system, or virtual display. Furthermore, it has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations (Ex parte Masham, 2 USPQ2d 1647 (1987)).

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Ishikawa et al (US 4861128) discloses an optical pickup using a waveguide and grating coupler. Kono et al (US 4779259) discloses an optical head assembly with efficient light source coupling surface and its method of construction. Asada et al (US 5142394) discloses an optical head device utilizing a grating. Kimura


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(US 2003/0180022) discloses an optical grating element which confines light within a substrate.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rhonda S. Peace whose telephone number is (571) 272-8580. The examiner can normally be reached on M-F (8-5).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Rodney Bovernick can be reached on (571) 272- 2344. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


Rhonda S. Peace
Examiner
Art Unit 2874


MICHELLE CONNELLY-CUSHWA
PRIMARY EXAMINER
3/2/06